NAVSEA
DAHLGREN

45th Annual NDIA Fuze Conference

PEO (S)

Mechanical Packaging of the EX 433 Proximity Fuze for Submunitions

18 April 2001

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NSWCDD G34

Fuze Branch

MK 45 MOD 4
Gun Mount

EX 3 Submunition
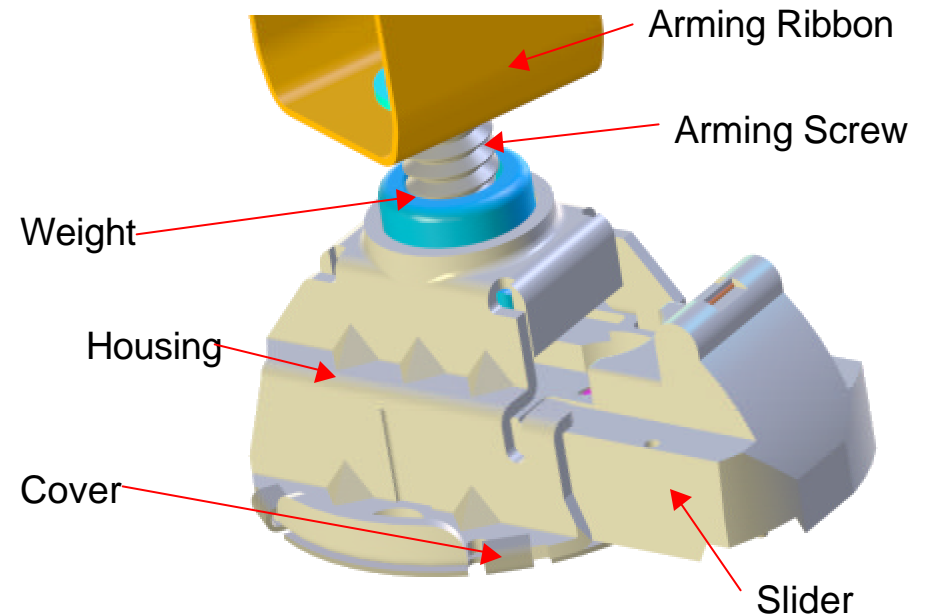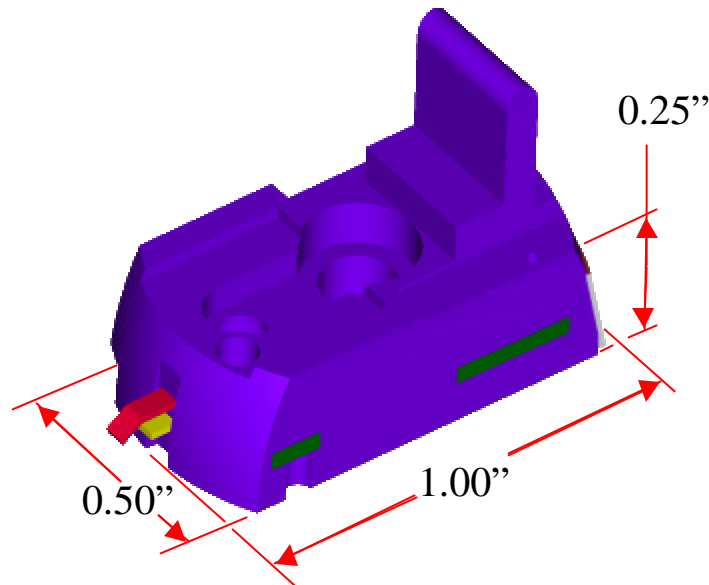w/ EX 433 Proximity
Fuze

ERGM: Extended Range Guided Munition

M80 PIP Objective

- **To package the electronics and mechanical components of the Proximity Fuze in the shape and size of the current M234 SD Slider for the M80 Submunition for ERGM**
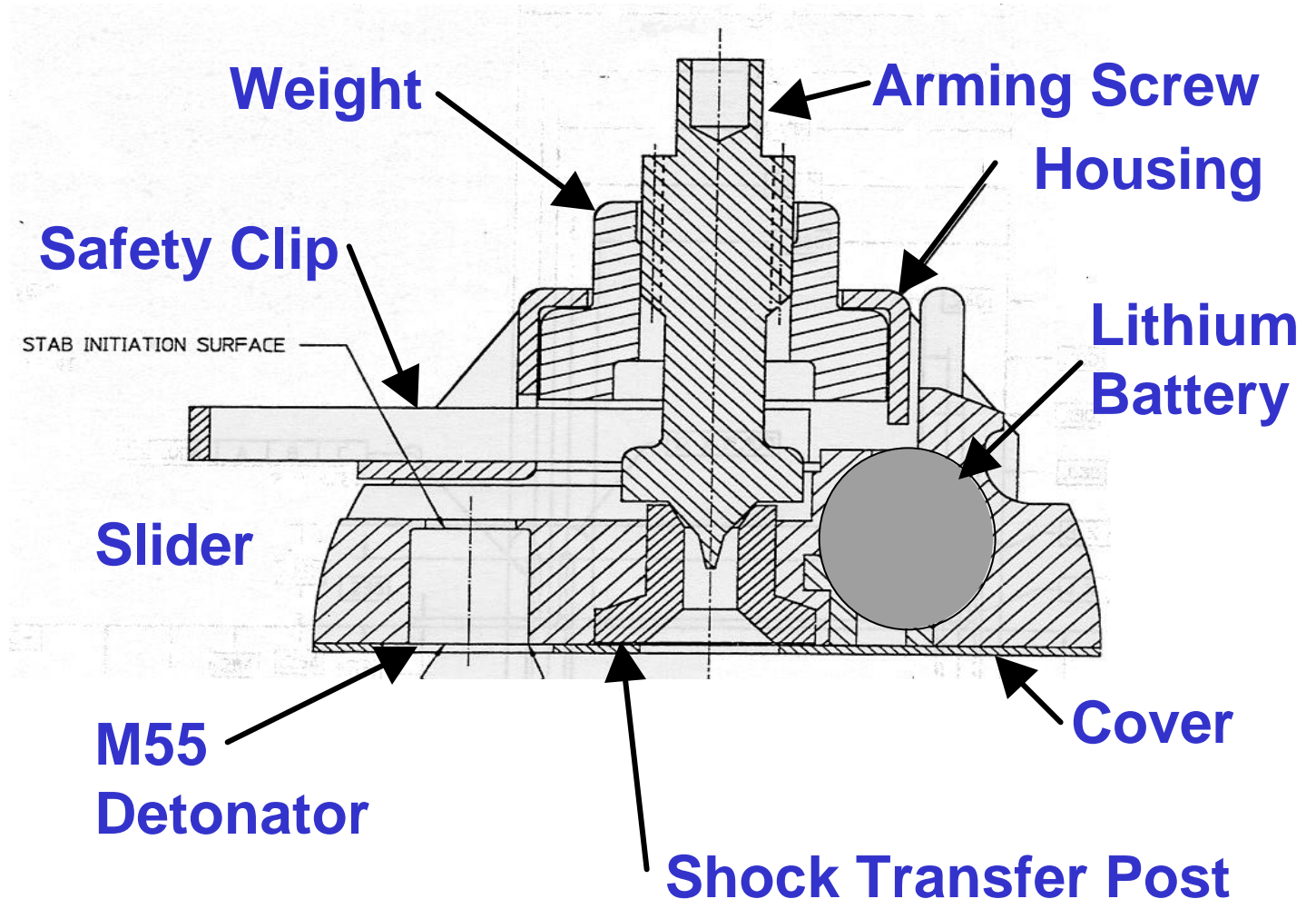 - One-for-One replacement of current Slider

0.25"

0.50"

1.00"

Arming Ribbon

Arming Screw

Weight

Housing

Cover

Slider

M234 Self-Destruct Fuze

M80 w/ M234

Weight

Arming Screw

Housing

Safety Clip

STAB INITIATION SURFACE

Lithium Battery

Slider

M55 Detonator

Cover

Shock Transfer Post
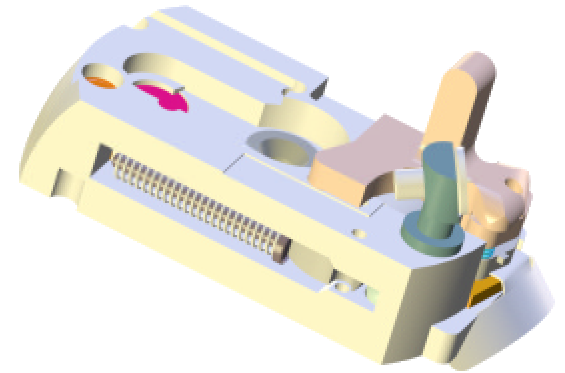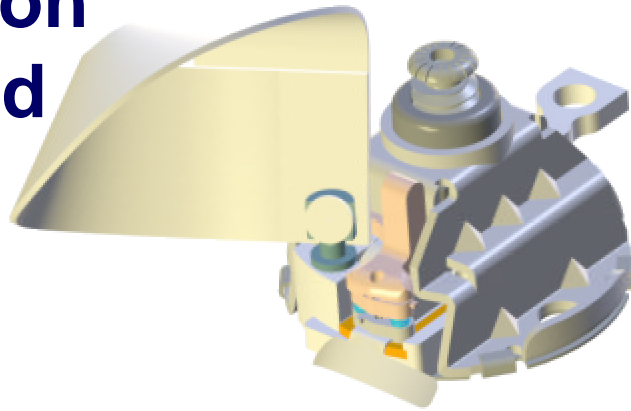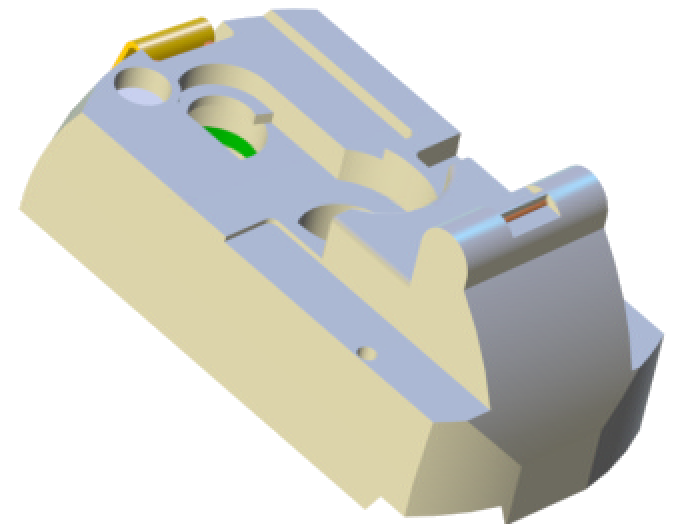
- **Battery Activation System removed**
  - Spring
  - Lever (hammer)
  - Pivot
  - Spiral Ribbon Assy
  - Ball
- **Shunt and Safety Pin removed**
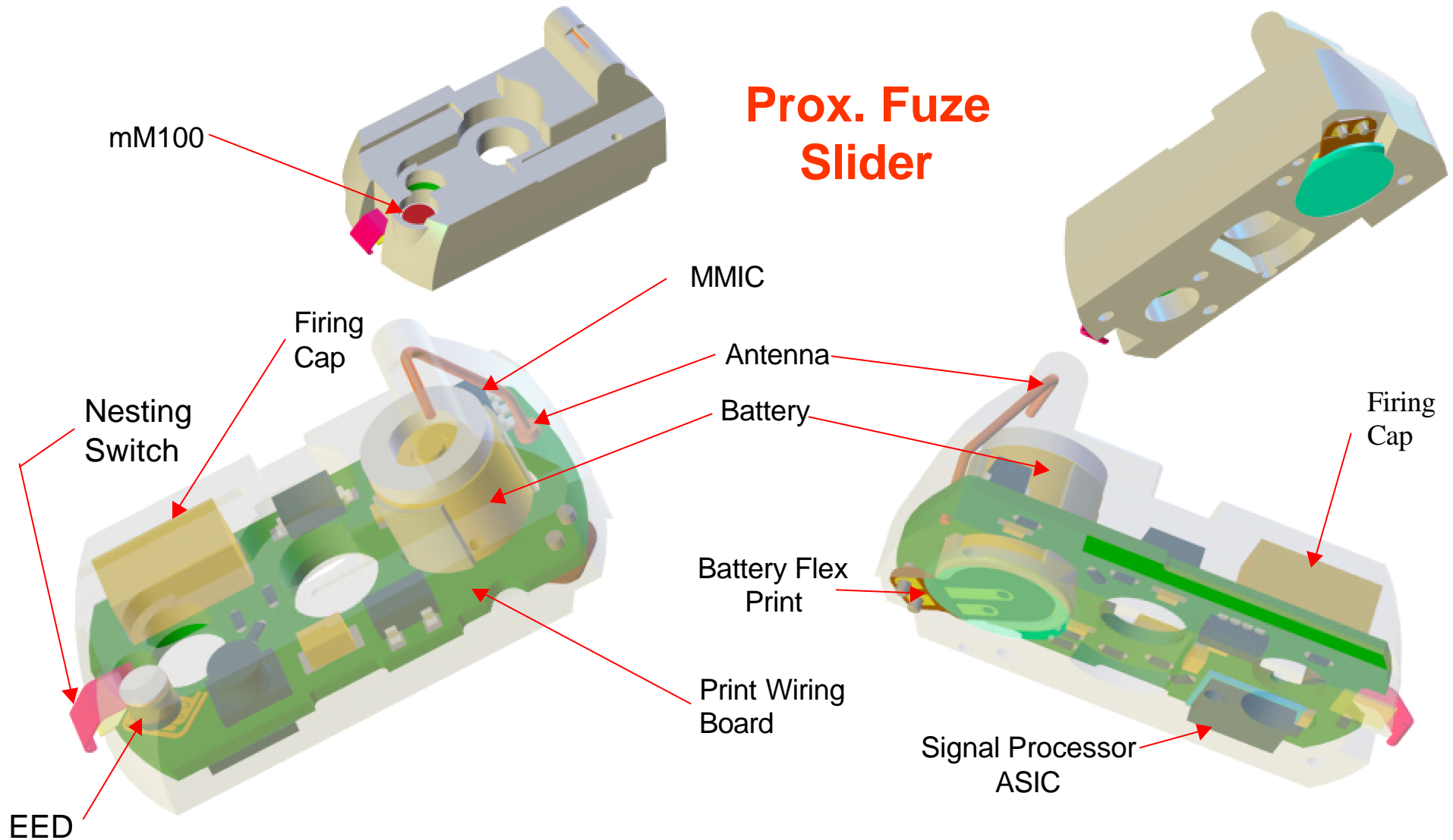- **Battery Cover removed**

Functions

- **Primary Mechanical Safety And Arming Features of the M234 SD Fuze Retained**

    – Impact Firing System is now the backup

- **Prox Fuze electronics will use two timers**

    – Separation Timer

    • Ensures proper event sequence

    – Battery activation and unnesting

    – Self-Destruct Timer

    • Provides the current cleanup capabilities of M234 SDF

    – Self-Neutralization or Self-Destruct

Major Components Layout

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Prox. Fuze Slider

- mM100
- MMIC
- Antenna
- Firing Cap
- Battery
- Nesting Switch
- Firing Cap
- Battery Flex Print
- Print Wiring Board
- EED
- Signal Processor ASIC

Battery

Nesting Switch

mM100

Battery

Nesting Switch

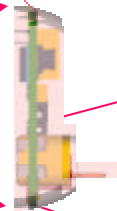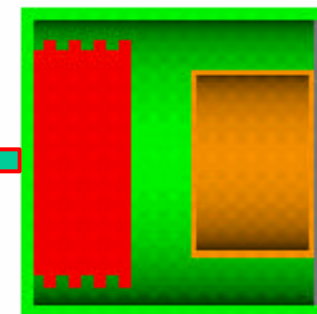## mM100

MK45 MOD4

Direction of Flight

ERGM
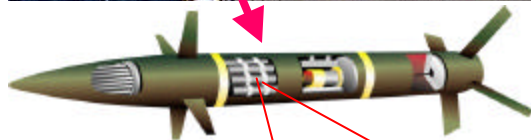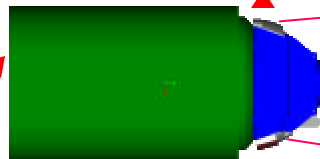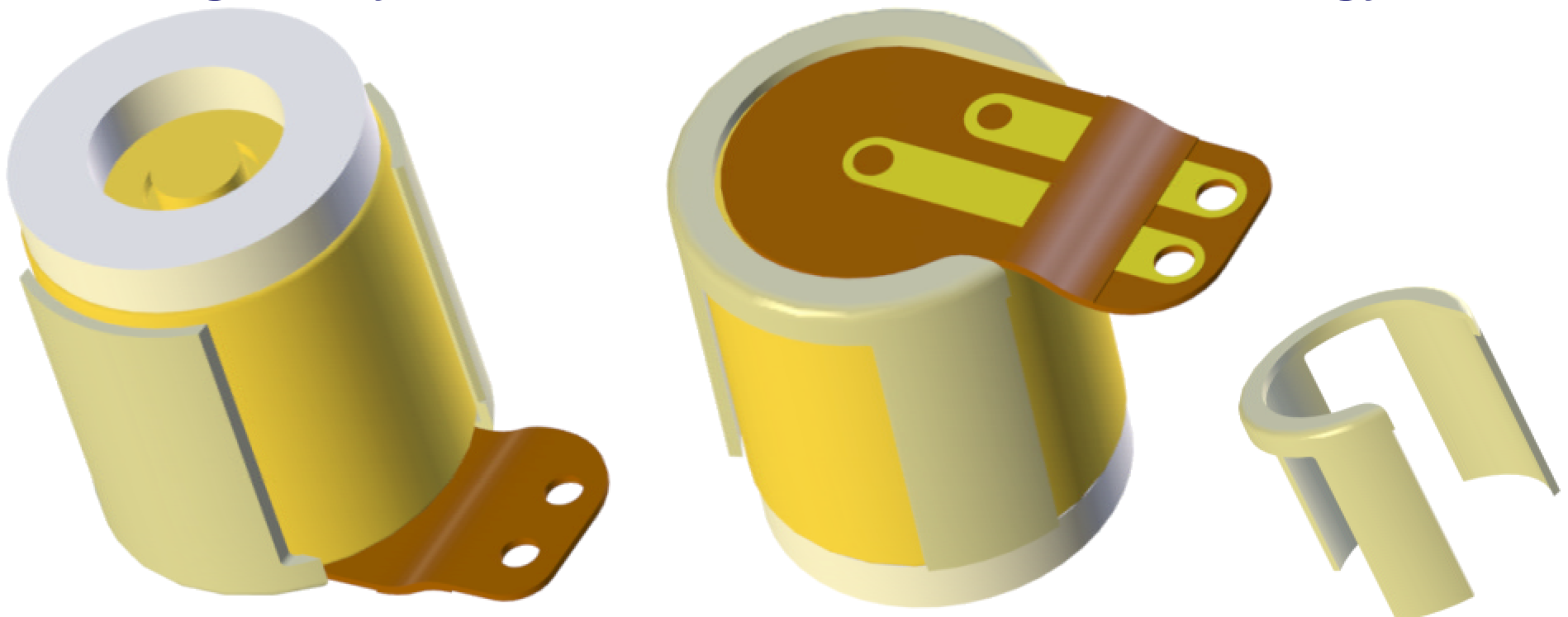
Slider

Prox. Fuze Battery

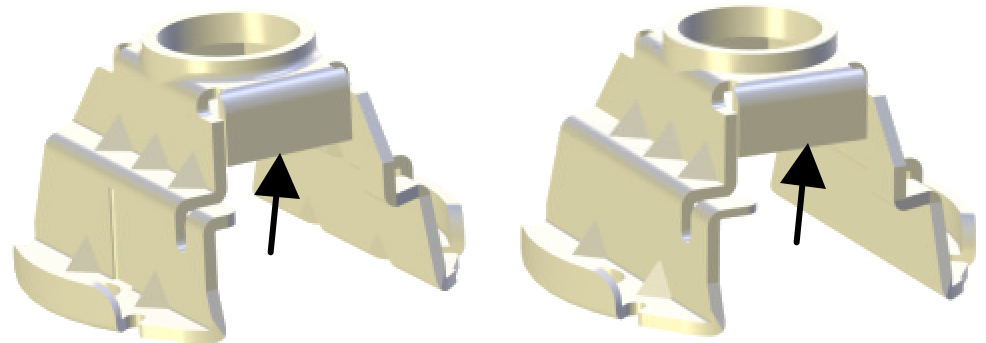EX-3

Force

Battery slides during Set Back
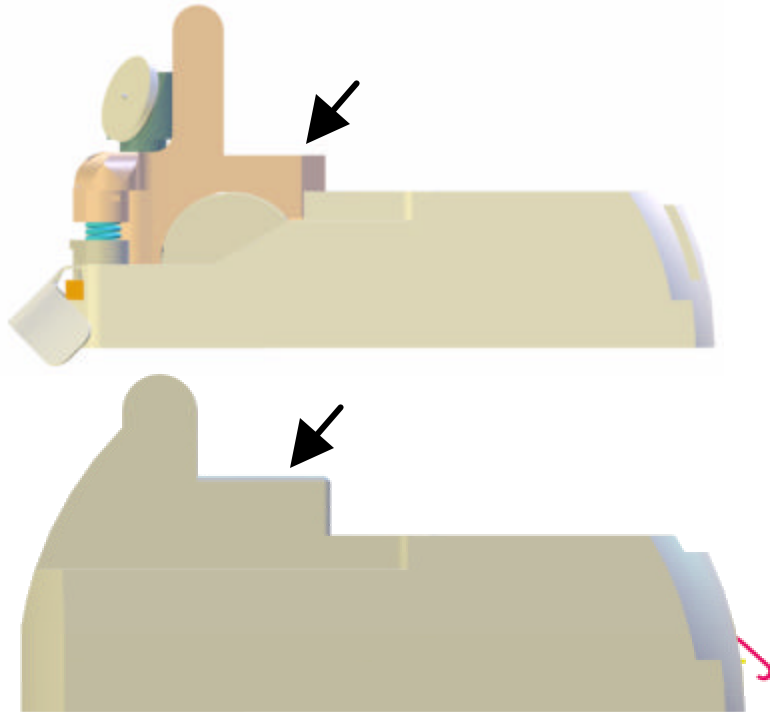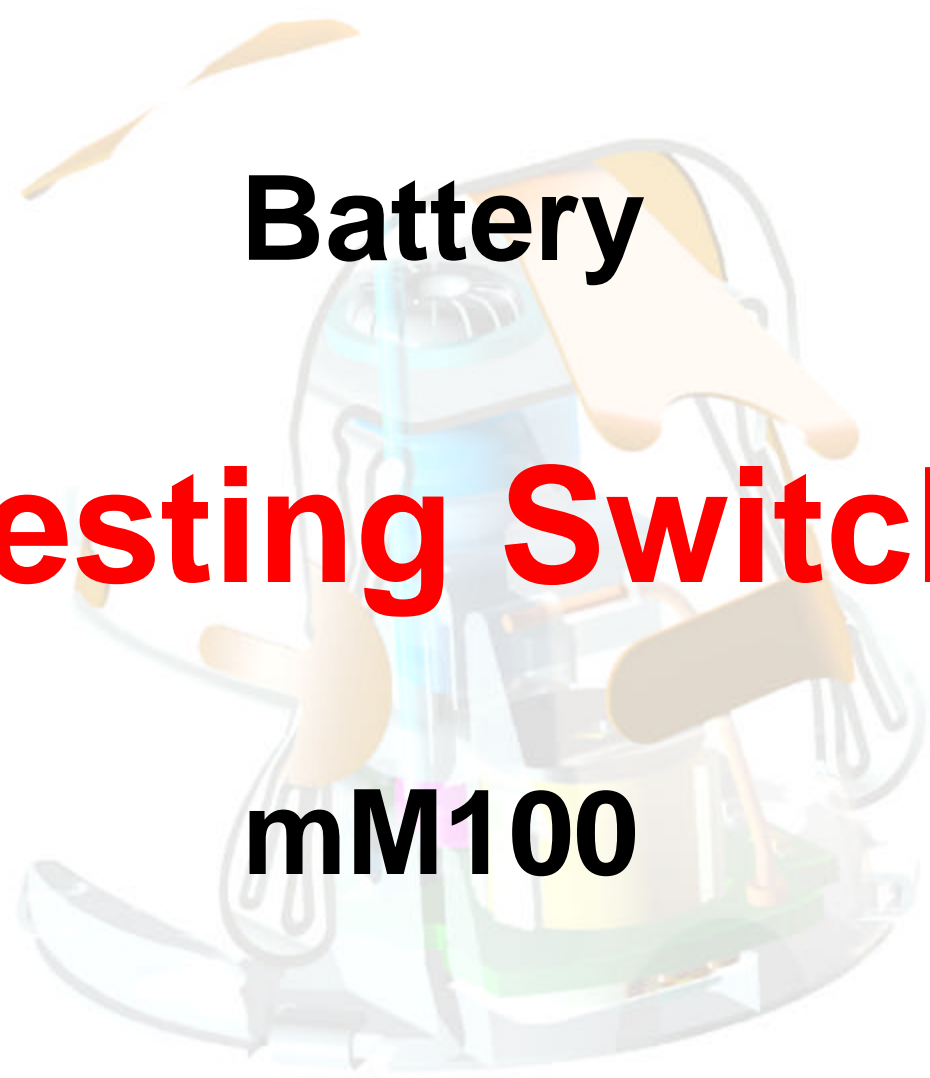
Battery

- **Requires a small nub to be molded into the plastic or a feature on the Battery**

- **Flex Print connection to Print Wiring Board**

- **Weight may be added to increase activation energy**

Taller Slider

- **Slider height increased to allow maximum room for Battery**

- **Tab on front of M234 Housing has been shortened**

Battery

Nesting Switch

mM100

Nesting Switch

- **Description**
  - Replaces the function of the Shunt on the M234 SDF
    - Self-Destruct timer
    - Room needed for Antenna, Battery, & electronic components
  - Prox. Fuze Sensor off line until submunitions dispensed
    - Reduces power consumption until M80's dispensed
  - Closed while the submunitions are nested in the payload
- **Allows Self-Destruct time to be reduced from 3 minutes to 60 seconds - desired by Marines**
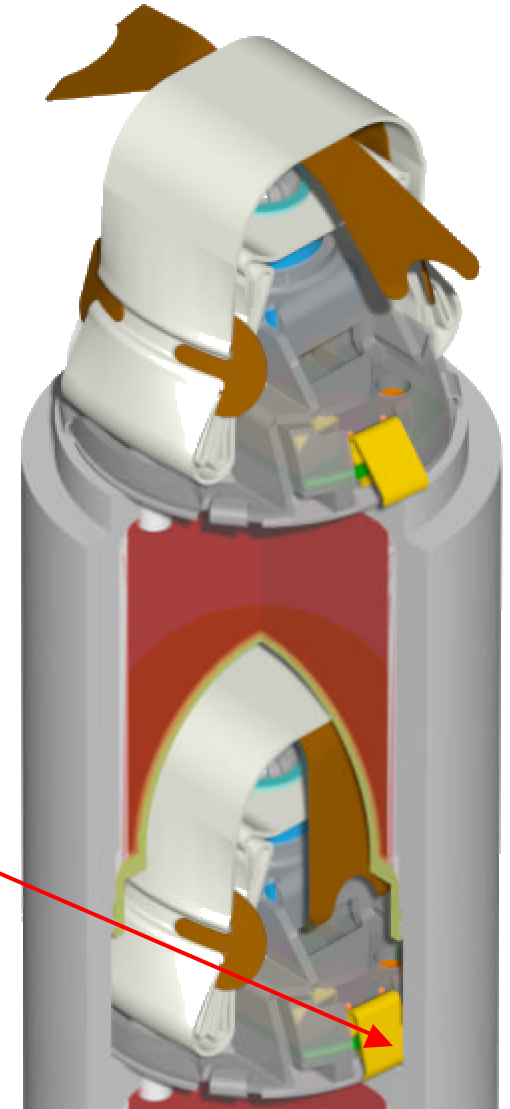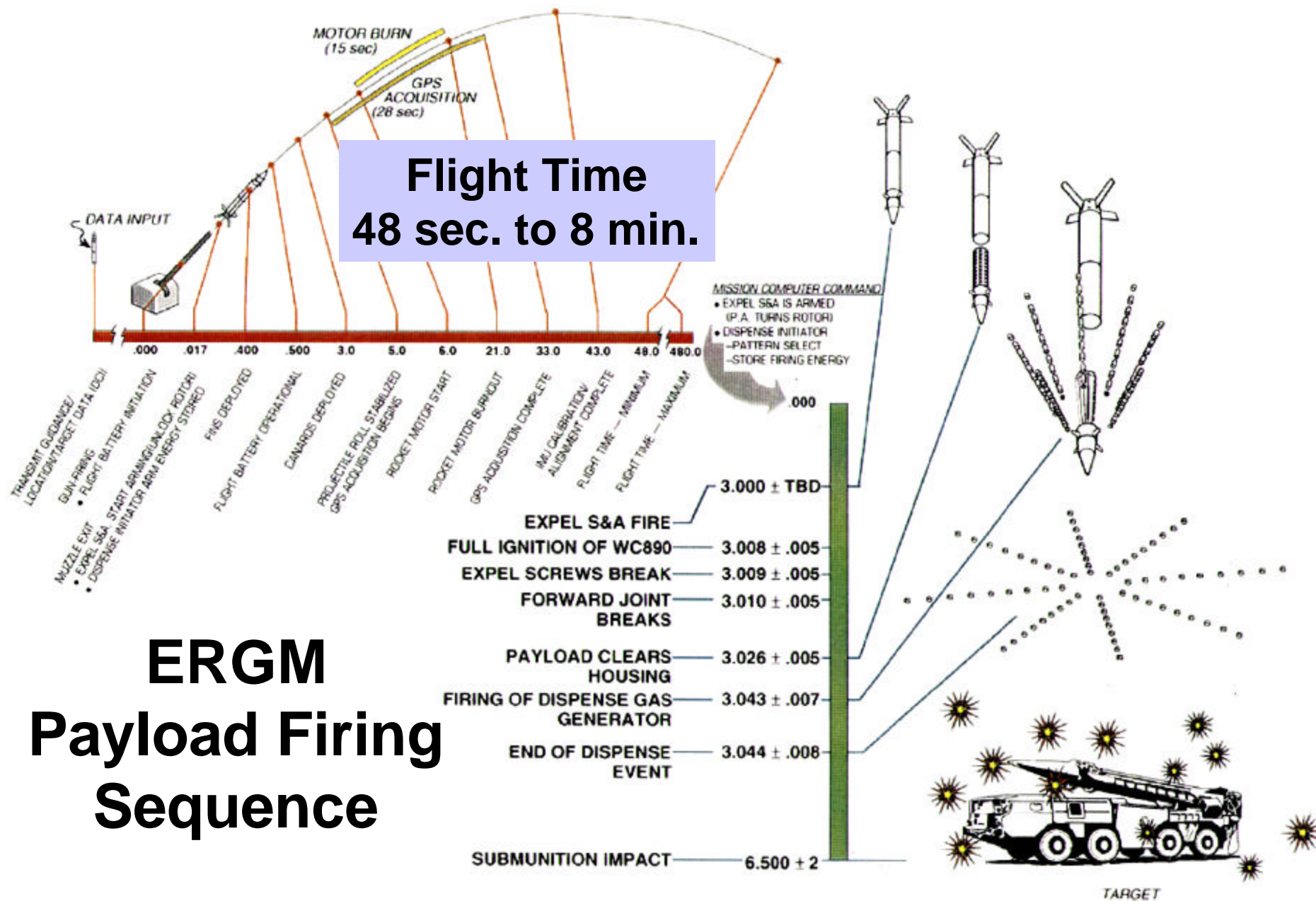
Nesting Switch

Nesting of grenades closes switch contacts

- **Fault Tree Analysis**
  - Shows the use of the Nesting Switch to be as safe as the Shunt

- **Safety Analysis**
  - Lone Star Army Ammunition Plant Concurs

Nested Submunitions

Nesting Switch compressed by stacked submunition

MOTOR BURN
(15 sec)

GPS
ACQUISITION
(28 sec)

DATA INPUT

**Flight Time
48 sec. to 8 min.**

MISSION COMPUTER COMMAND
- EXPEL S&A IS ARMED
  (P.A. TURNS ROTOR)
- DISPENSE INITIATOR
  –PATTERN SELECT
  –STORE FIRING ENERGY

.000   .017   .400   .500   3.0   5.0   6.0   21.0   33.0   43.0   48.0   480.0

TRANSMIT GUIDANCE/
LOCATION/TARGET DATA (DCI)
GUN FIRING
FLIGHT BATTERY INITIATION
MUZZLE EXIT
EXPEL S&A START ARM/GUN-COLK ROTOR)
DISPENSE INITIATOR ARM ENERGY STORED
FINS DEPLOYED
FLIGHT BATTERY OPERATIONAL
CANARDS DEPLOYED
PROJECTILE ROLL STABILIZED
GPS ACQUISITION BEGINS
ROCKET MOTOR START
ROCKET MOTOR BURNOUT
GPS ACQUISITION COMPLETE
IMU CALIBRATION/
ALIGNMENT COMPLETE
FLIGHT TIME — MINIMUM
FLIGHT TIME — MAXIMUM

**ERGM
Payload Firing
Sequence**

.000

	3.000 ± TBD
EXPEL S&A FIRE	
FULL IGNITION OF WC890	3.008 ± .005
EXPEL SCREWS BREAK	3.009 ± .005
FORWARD JOINT BREAKS	3.010 ± .005
PAYLOAD CLEARS HOUSING	3.026 ± .005
FIRING OF DISPENSE GAS GENERATOR	3.043 ± .007
END OF DISPENSE EVENT	3.044 ± .008
SUBMUNITION IMPACT	6.500 ± 2

TARGET

Accident Scenario

- **Assumption:**
  - The accident in some way has activated the Battery and the electronics are powered up
   - Drop, Accidental Expulsion
- **Safety Logic:**
  - The Signal Processor IC will compare the Nesting Switch condition and Separation Timer (Battery activation time)
    - If the Nesting Switch is opened within 30 seconds of Battery activation the Prox. Fuze will safe itself
    - If the Nesting Switch is closed in the nested state and the Battery has been activated for 10 minutes the Prox. Fuze will safe itself

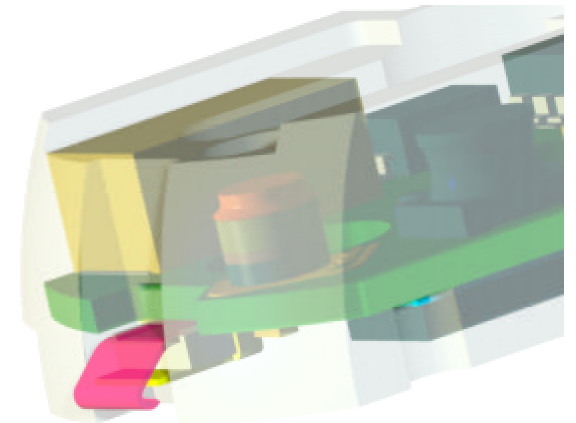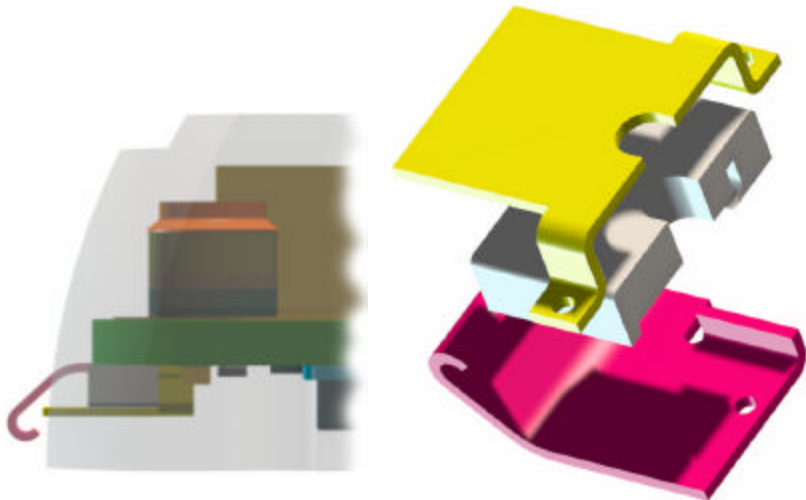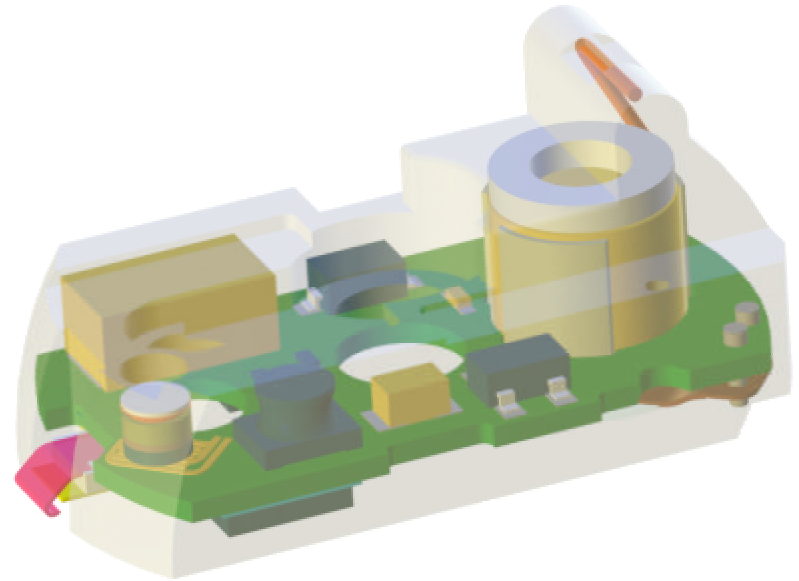*** Point Detonate Safety Issue still a concern**

Nesting Switch Concept #1
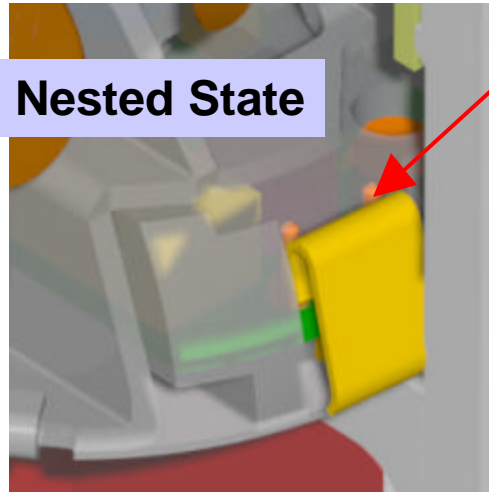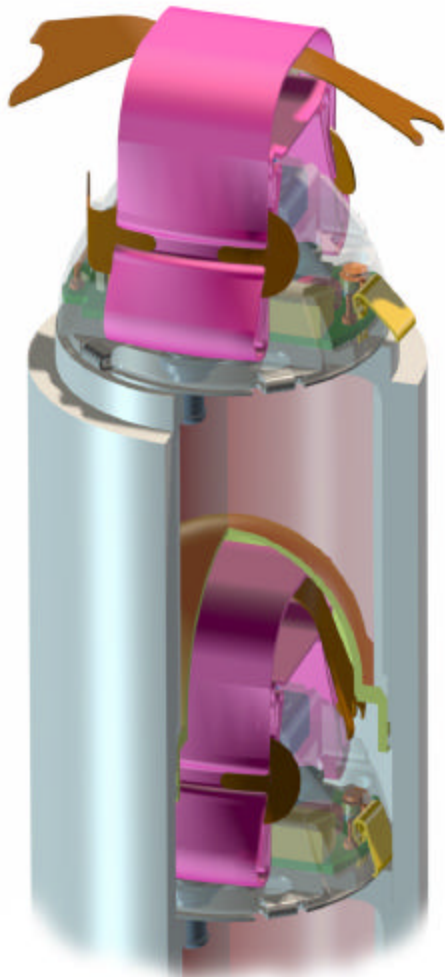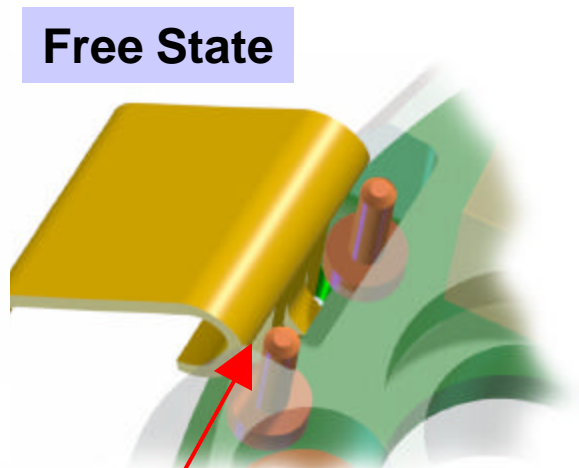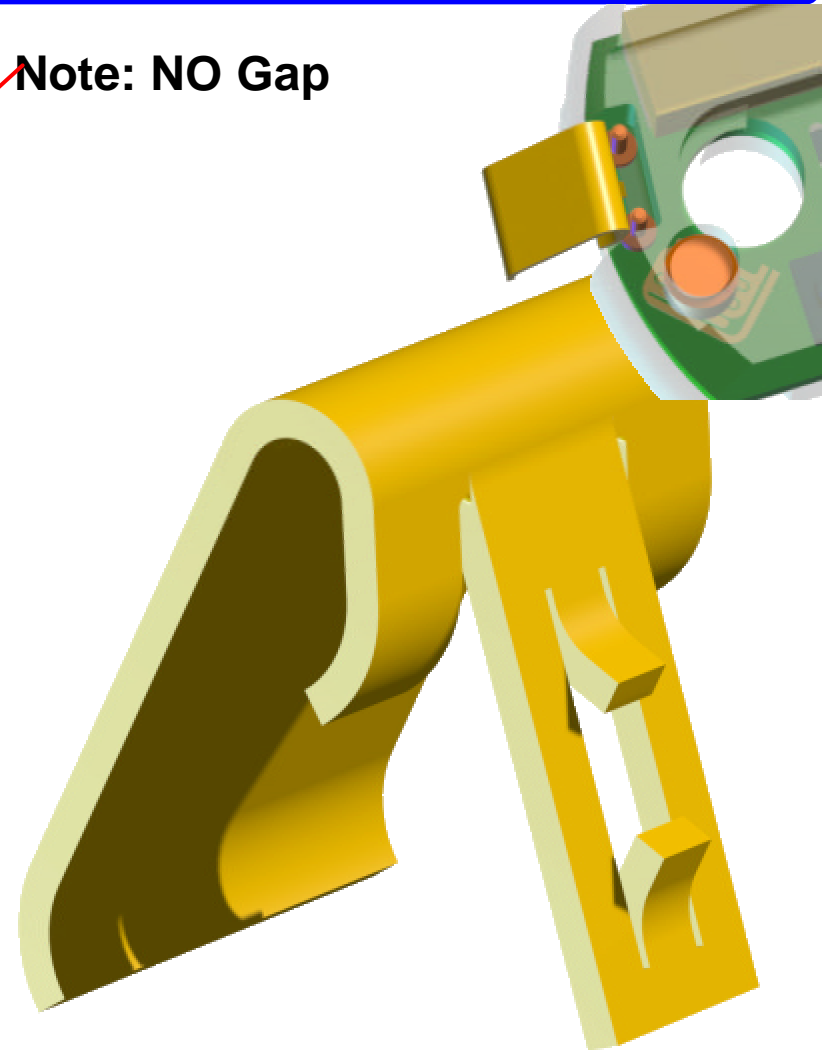
Nesting Switch Concept #2

- The PWB is molded to form the Slider

- The two Nest Switch leaves are molded together
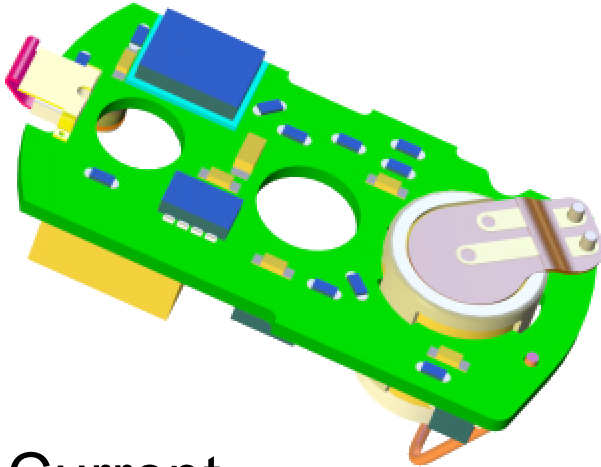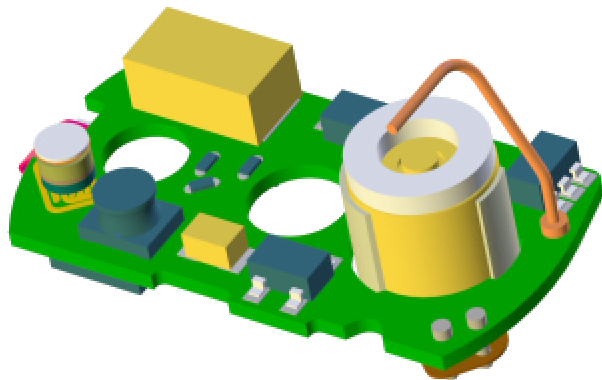
- Then soldered to the Slider Sub-Assembly
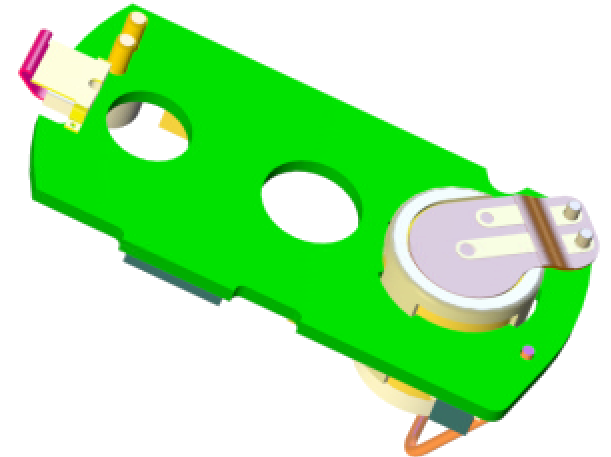
Battery

Nesting Switch
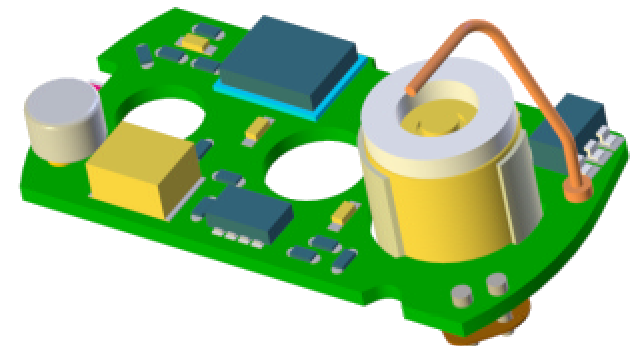
mM100

EED vs. mM100

Current
M234 EED
Version

mM100 design offers
- Reduced component count
- Reduced component sizes
- Reduced testing
- Single sided PWB
- Reduced PWB costs
- Increase reliability

- No impact on battery
- Either Nesting Switch concept

mM100
Version

Summary

- **Teamwork**
  - Government and Contractor
  - Battery, Electronics, and Mechanical Packaging Teams